Space Weather Forecast

Issued on Saturday, 11 November 2023 at 01:11 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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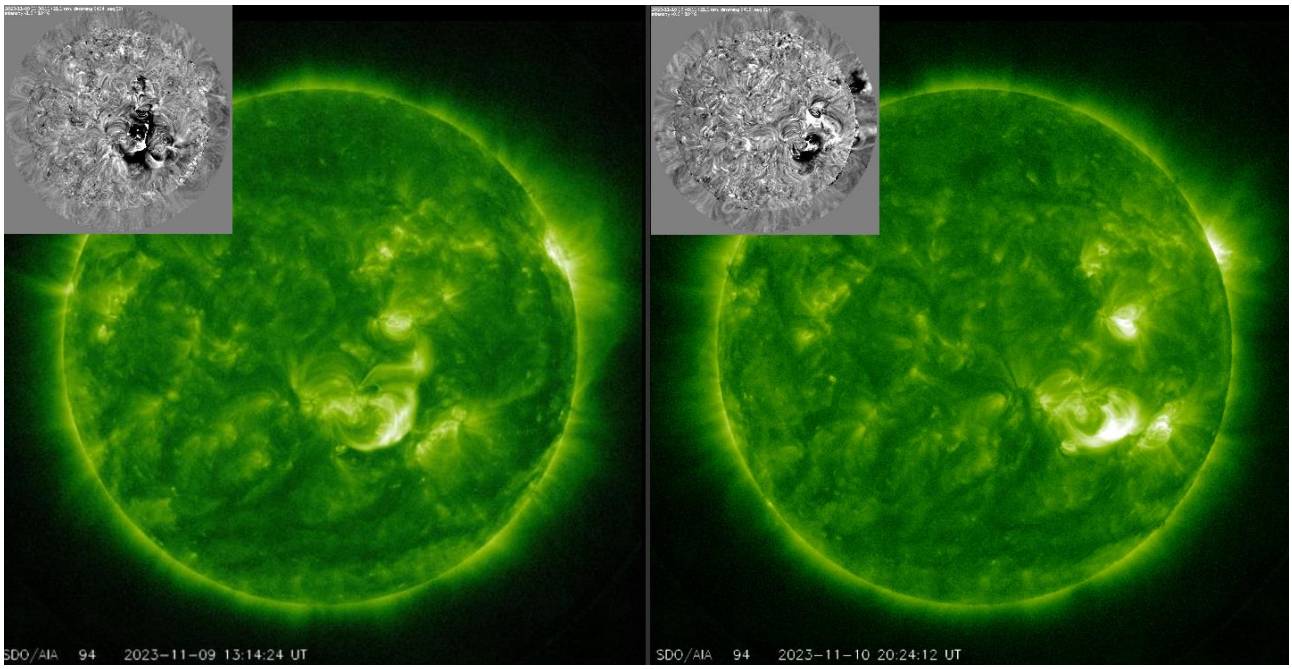
Space Weather Forecast Headline: G1 to G2 Minor to Moderate geomagnetic storm expected over UTC weekend, chance G3 Strong geomagnetic storm at peak.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been low over the UTC day of Friday 10 November, with X-rays registering at low Common-class. The largest of these flares was observed from a sunspot in the southwest at 10/1604UTC. Also of note was a long-period Common-class flare around 10/1930UTC from a potentially complex portion of the Sun encompassing up to three sunspot regions to its immediate east. This flare was accompanied by a modest 'coronal dimming', and appears to have generated a Coronal Mass Ejection (CME). This source region is in the same vicinity as that which produced the Earth-directed CME of 09 November, which currently dominates the geomagnetic forecast, although this event appears much more modest and has yet to be confirmed.

Figure 1: False-colour extreme UV imagery of the 09 November CME-associated Common-class flare (left) and the more recent instance from 10/1930UTC (right). Also shown are nested time-integrated 'coronal dimming' signatures, processing courtesy of SIDC ROB. The 10 November event has yet to be analysed, and while of lower magnitude and a more westward heading, Earth impacts cannot yet be ruled out.



There are now six sunspot regions on the Sun, with these all somewhat clustered in the western solar hemisphere and especially in the southwest. The most complex group remains in the

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northwestern quadrant, and showed proliferation and spreading of its intermediate spots in the period.

Satellite imagery for the 24 hours showed a far-sided eastern solar hemisphere CME of uncertain origin, a non-Earth directed southwestern solar horizon event around 10/1200UTC as well as some high latitude activity in the northwest. At the time of writing, a late-UTC day apparently westward-heading CME was becoming visible, probably associated with the long-period Common-class flare at 10/1930UTC. Modelling of this event will be conducted in due course. A final candidate for a CME was observed at high latitudes near the solar meridian in extreme UV at 10/2130UTC. This is perhaps a CME from a 'filament lift-off' (arc of plasma leaving the Sun), although no Earth-based observatories captured the event. Any CME is awaited in imagery. No new Earth-directed CMEs were therefore in evidence.

Solar Wind / Geomagnetic Activity: Solar winds overall are felt to be reflective of the waning enhancement from a fast wind regime stemming from a 'coronal hole'.

Solar wind speeds fell from strong to elevated, while the number of particles comprising the wind was steady and at background levels. The associated magnetic field was steady and comfortably within background, with a varying and small-scale north-south component. The net result of the above solar wind measures was for provisionally mainly quiet geomagnetic activity.

Energetic Particles / Solar Radiation: Solar radiation fell from a peak value of 2.7pfu at 10/0015UTC (note that S1, Minor Solar Radiation Storm, starts at 10pfu). This later approached its typical resting background level around a decade lower by the UTC evening. The peak level was attained in response to the Common-class flare and associated 09 November Earth-directed CME.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity carries a daily slight chance of increasing to moderate, although recent flare activity has been low and is therefore perhaps the least noteworthy aspect of the forecast.

Solar Wind / Geomagnetic Activity: One CME from the southwest at 10/1930UTC is awaiting imagery for assessment, with a second candidate for a CME also seen at 10/2130UTC.

The geomagnetic forecast is otherwise dominated by the expected arrival of the 09 November CME, currently posited for 12/0001UTC. G1 to G2 Minor to Moderate geomagnetic storms are expected at peak, with a chance of G3 straddling the midnight separating both UTC days. Geomagnetic activity leading up to and subsequent to this is expected to be much quieter, most reliably so to end the four-day period.

Energetic Particles / Solar Radiation: There is a daily slight chance of S1 or greater should any of the western solar hemisphere sunspot groups produce suitable flares in the period. This risk should begin to wane towards the middle of the coming UTC working week as these sunspots progress onto the far side.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	70	90	20	1
Strong	G3	No	30	30	1	1
Severe	G4	No	5	5	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	20	20	15
Very Active	R3 to R5 X	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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